

**REMARKS**

Claims 1-4, 6-23 and 25-82 remain pending in the present application. Claims 37-66, 69-74 and 77-80 have been withdrawn from consideration by the Examiner. Claims 11, 12, 30, 31, 81 and 82 were objected to by the Examiner as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include the limitations of the base claim and any intervening claims. New claims 83-87 have been presented for consideration by the Examiner and are believed to be directed to patentable subject matter. Applicant appreciates the Examiner's consideration of the Application.

**The § 102 Rejections**

The Examiner rejected Claims 1-4, 6-9, 15, 16, 20-23, 25-28, 67, 68, 75, and 76 under 35 USC 102(b) as being anticipated by U.S. Patent no. 5,770,100 issued to Fukuyama et al (hereinafter the '100 patent). Applicants respectfully traverse at least for the reasons discussed hereinafter.

Before addressing the rejections that have been made under the art of record, it is appropriate to briefly discuss the limitations of claim 1, as amended. In particular, claim 1 is directed to a system that is configured for removing an implant crust that is produced responsive to a high dose ion implantation without the use of halogens. The formation of such an implant crust, as well as its physical characteristics, are described, for example, in paragraph 39 of Applicant's specification. This crust is illustrated in figure 4 of Applicant's disclosure. It should be appreciated that such a crust results from an interaction between with high energy bombarding dopant ions and photoresist that is supported on a surface of the treatment object. These dopant ions ultimately form part of the device structure that is being created in areas that are not protected by the photoresist.

Turning now to the rejection of claim 1, the Examiner relies on the '100 patent as anticipating this combination of limitations. In making out the rejection, the Examiner refers to column 1 of the '100 patent carrying over to column 2. While line 65 of column 1 mentions implantation of ions due to bombardment. It should be appreciated that these ions are merely halogen components, they are not dopant atoms that are intended to form part of the overall structure of the device that is being fabricated, as is required by claim 1. Further, there is no mention of crust formation, the removal of which is the very objective of claim 1. In this regard, the Examiner cites column 5, lines 30-64 and column 7, lines 7-25 of the '100 patent as assertedly teaching the removal of a process material crust. Applicants respectfully disagree. Applicants find no teaching, disclosure, or suggestion in the cited portions of the '100 that would reasonably lead one to believe that a crust is formed. Further, Applicants find no teaching, disclosure or suggestion with respect to any need to remove such a crust. The '100 patent merely states that some halogen components can be implanted in the photoresist.

It should be appreciated that these halogen components are not dopants. Dopants are driven into the active device structure, as described in Applicant's disclosure, and are therefore simultaneously driven into the photoresist. It should be understood that the halogen components are actually introduced by the process that the '100 patent is teaching for forming a wiring pattern. In this regard, the Examiner has taken an isolated teaching of the patent out of context and ignored what the reference fairly teaches as a whole to one having ordinary skill in the art. Specifically, the '100 patent teaches etching the wiring pattern by exposing the photoresist and unmasked areas of the wiring pattern layer to a halogen containing plasma. Thereafter, there is a need to remove the halogens, introduced by the process, in order to prevent corrosion that they would

MAT-4

11 of 16

USSN 10/665,267

subsequently cause. Thus, the removal of the halogens is necessitated by the process itself. In this regard, the technique of the '100 patent would benefit by Applicant's recognition that the halogens can damage the active device structure, since this damage can occur during etching. Applicants have recognized that it is advantageous not to expose an implant crust or the underlying photoresist to a halogen containing plasma since the halogens can attack and damage the treatment object, as described, for example, in paragraph 31 of Applicant's specification.

In view of the foregoing, Applicants consider that the '100 patent teaches directly away from claim 1 by initially exposing the photoresist to a halogen containing plasma during the process. It should be appreciated that removal of the tough, hardened implant crust (see paragraph 39 of Applicant's specification) necessarily corresponds to the first step in the overall photoresist removal process and that the first step in the '100 patent deliberately exposes the photoresist to a halogen containing plasma. Thereafter, the technique of the '100 patent is directed to removal of halogens that were introduced by the process itself. In contrast, amended claim 1 requires the avoidance of the use of halogens.

With respect to the Examiner's argument that it is not necessary for the '100 patent to specify a "dose" with respect to the halogen components, it should be appreciated that the term "dose" is related to the number of dopant atoms that are intended to be introduced within any given area of that active device structure. Thus, this term does not reasonably relate to photoresist removal since dopants are not being implanted.

Briefly considering the "intended use" concerns of the Examiner, Applicants note that a system that is configured to operate in accordance with the limitations of claim 1, as amended, is respectfully considered to be structurally different from the prior art. In this regard, Applicants note that the limitations present in claim 1 are considered to be functional and appear in the body of the claim, rather than being directed to an intended use in the preamble of the claim. Functional limitations are clearly acceptable, as is particularly evidenced by the provision for means plus function language in 35 U.S.C. § 112. Accordingly, for all of the foregoing reasons, allowance of claim 1 over the art of record is respectfully requested.

Claims 2-4, 6-9, 15 and 16, as amended, each depend either directly or indirectly from and therefore include the limitations of claim 1. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to claim 1. Further, each of these dependent claims places additional limitations on their parent and intermediate claims which, when considered in light of claim 1, further distinguish the claimed invention from the art of record.

With respect to claims 2-4, the Examiner again refers to col. 5 of the '100 patent. As discussed above, however, there is no photoresist implant crust present. Accordingly, there is no implant crust for removal. It should be appreciated that Applicants have recognized the usefulness of these radicals in the context of removal of an implant crust. Further, Applicants respectfully continue to believe that the Examiner's reliance on paragraph 28 of Applicant's specification is inappropriate for purposes of supporting the teachings of the '100 patent. In this regard, Applicants respectfully view this as equivalent to rejecting Applicant's claims under § 103 with Applicant's own specification as a secondary reference. Clearly, this is not appropriate in making out an inherency rejection under § 102. It is well-settled that a proper rejection under § 102, requires finding each and every limitation within a single reference, either explicitly or under the doctrine of inherency. Combining

references under § 102 is impermissible. Accordingly, withdrawal of any aspect of the rejections that are formulated on this basis is respectfully requested.

Claim 20 is an independent claim which reflects the limitations of claim 1, but in method form. Accordingly, it is considered that the arguments presented above, in favor of the patentability of claim 1 over the art of record, equally favor the patentability of claim 20. Moreover, the assertion that the "intended use" limitations must result in a structural difference in making out the rejection of this claim is not understood, since the claim is in method form. Hence, for at least these reasons, allowance of claim 20 is respectfully requested.

Claims 21-23 and 25-28 each depend either directly or indirectly from and therefore include the limitations of claim 20. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to claim 20. Further, each of these dependent claims places additional limitations on their parent and intermediate claims which, when considered in light of claim 20, further distinguish the claimed invention from the art of record.

For example, claims 21-23 reflect the limitations of claims 2-4, but in method form. Accordingly, it is considered that the arguments, made above in behalf of the patentability of claims 2-4, equally favor the patentability of claims 21-23, respectively. Hence, for at least these reasons, allowance of claims 21-23 is respectfully requested.

Claim 67, as amended, is an independent claim that, like claim 1, is directed to a system that is configured for removing an implant crust that is produced responsive to the introduction of dopant atoms. With respect to the failure of the '100 patent to reasonably teach, disclose or suggest the removal of an implant crust, the arguments made above in behalf of the patentability of claim 1 over the art of record are considered to be equally applicable with respect to the patentability of claim 67, as amended. With respect to the Examiner's concerns as to "intended use" limitations, it is considered that these concerns have been addressed by the amendments above in conjunction with recognizing that the limitations present in claim 67, like those of claim 1, are functional rather than being directed to an intended use. Further, Applicants respectfully continue to believe that the Examiner's reliance on paragraph 28 of Applicant's specification is inappropriate for purposes of supporting the teachings of the '100 patent, as discussed above with respect to claims 2-4. Hence, for at least these reasons, allowance of claim 67 is respectfully requested.

Claim 68 is an independent claim which reflects the limitations of claim 67, but in method form. Accordingly, it is considered that the arguments presented above, in favor of the patentability of claim 67 over the art of record, equally favor the patentability of claim 68. Moreover, the assertion that the "intended use" limitations must result in a structural difference in making out the rejection of this claim is not understood, since the claim is in method form. Hence, for at least these reasons, allowance of claim 68 is respectfully requested.

Claim 75, as amended, is an independent claim that, like claim 1, is directed to a system that is configured for removing an implant crust that is produced responsive to the introduction of dopant atoms. With respect to the failure of the '100 patent to reasonably teach, disclose or suggest the removal of an implant crust, the arguments made above in behalf of the patentability of claim 1 over the art of record are considered to be equally applicable with respect to the patentability of claim 75, as amended. With respect to the Examiner's concerns as to "intended use" limitations, it is considered that these

MAT-4

13 of 16

USSN 10/665,267

concerns have been addressed by the amendments above in conjunction with recognizing that the limitations present in claim 75, like those of claim 1, are functional rather than being directed to an intended use. Hence, for at least these reasons, allowance of claim 75 is respectfully requested.

Claim 76 is an independent claim which has been amended to reflect the limitations of amended claim 75, but in method form. The arguments made above in favor of the patentability of claim 75, over the art of record, are therefore considered to be equally applicable with respect to the patentability of claim 76. With respect to the Examiner's concerns as to "intended use" limitations, it is considered that these concerns have been addressed by the amendments above in conjunction with recognizing that the limitations present in claim 75, like those of claim 1, are functional rather than being directed to an intended use. Moreover, the assertion that the "intended use" limitations must result in a structural difference in making out the rejection of this claim is not understood, since the claim is in method form. Accordingly, for at least these reasons, allowance of claim 76 over the '100 patent is respectfully requested.

The Examiner rejected claims 1, 17, 19, 20, 34 and 36 under 35 USC 102(b) as being anticipated by U.S. Patent no. 5,763,328 issued to Yoshihara et al (hereinafter the '328 patent). Applicants respectfully traverse at least for the reasons discussed hereinafter.

Applicants initially note that the '328 patent is similar in spirit to the '100 patent. That is, the '328 patent deals with corrosion issues, after etching an aluminum layer with the highly corrosive halogen, chlorine, as described, for example, at col. 2, lns. 27-29. Further, Applicants find no reasonable teaching, disclosure or suggestion with respect to the presence of an implant crust. Again, as discussed above, chlorine, like all halogens, will not form an implant crust having the characteristics that are produced by high dose implantation of a dopant species. As is the case with the '100 patent, as discussed above, it should be understood that the halogen components are actually introduced by the process that the '328 patent is teaching for forming a wiring pattern. In this regard, the Examiner has taken an isolated teaching of the '328 patent out of context and ignored what the reference fairly teaches as a whole to one having ordinary skill in the art. Specifically, the '328 patent teaches etching the wiring pattern by deliberately introducing and exposing the photoresist and unmasked areas of the wiring pattern layer to a halogen containing plasma. Thereafter, there is a need to remove the halogens in order to prevent corrosion that they would cause. Again, the removal of the halogens is necessitated by the process itself. Applicants have recognized that it is advantageous not to expose an implant crust or the underlying photoresist to a halogen containing plasma since the halogens can attack and damage the exposed regions of the treatment object. Therefore, Applicants consider that the '328 patent teaches directly away from claim 1 by initially exposing the photoresist to a halogen containing plasma during the etching process. It should be appreciated that removal of the tough, hardened implant crust (see paragraph 39 of the specification) necessarily corresponds to the first step in the overall photoresist removal process and that the first step in the '328 patent exposes the photoresist to a halogen containing plasma. Specifically, the plasma contains chlorine. In this regard, the technique of the '328 patent would benefit by Applicant's recognition that the halogens can damage the active device structure, since this damage can occur during etching. Thereafter, the technique of the '328 patent is directed to removal of halogens that were introduced by the process itself. In contrast, amended claim 1 requires the avoidance of the use of halogens. Accordingly, for at least these reasons, allowance of claim 1, as amended, over the '328 patent is respectfully requested.

Claims 17 and 19 each depend directly from and therefore include the limitations of claim 1. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to claim 1. Further, each of these dependent claims places additional limitations on their parent and intermediate claims which, when considered in light of claim 1, further distinguish the claimed invention from the art of record.

Claim 20, as amended, is an independent claim which includes the limitations of amended claim 1, as discussed above, but in method form. Accordingly, the arguments made above in behalf of the patentability of amended claim 1 over the art of record are considered to be equally applicable with respect to the patentability of amended claim 20. Therefore, claim 20, as amended, is considered to be allowable over the '328 patent for at least these reasons.

Claims 34 and 36 each depend directly from and therefore include the limitations of claim 20. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to claim 20. Further, each of these dependent claims places additional limitations on their parent and intermediate claims which, when considered in light of claim 20, further distinguish the claimed invention from the art of record.

#### **The § 103 Rejections**

The Examiner rejected claims 10, 17-19, 29 and 34-36 under 35 USC § 103(a) as being unpatentable over the '100 patent. Applicants respectfully traverse. Claims 10 and 17-19 each depend directly from and therefore include the limitations of amended claim 1, while claims 29 and 34-36 each depend directly from and therefore include the limitations of amended claim 20. Accordingly, it is respectfully submitted that each of these claims is also patentable over the art of record for at least the reasons set forth above with respect to amended claims 1 and 20, respectively. Further, each of these dependent claims places additional limitations on its parent claim which, when considered in light of amended claims 1 and 20, further distinguish the claimed invention from the art of record.

#### **Conclusion**

New claims 83-87 have been presented for consideration by the Examiner and are believed to be directed to patentable subject matter. For example, independent claim 83 is directed to an overall technique for exposing a workpiece and photoresist thereon to a high dose ion implantation of dopant atoms such that an implant crust is generated as an outer layer of the photoresist responsive to the implantation. The implant crust is then removed using a plasma that is formed from a hydrocarbon gas in combination with oxygen gas such that the plasma is halogen free, at least to an approximation. Applicant is unable to find these limitations in the art of record in any reasonable combination.

As another example, new claim 84 depends directly from new claim 83 and requires that the implant species is selected as one of arsenic, phosphorus and boron. In this regard, the art of record is directed to etching processes that are not considered as reasonably disclosing implant species.

As still another example, new claim 85 depends directly from new claim 83 and recites that the workpiece is exposed to an ion energy ranging from 5KeV to 500 KeV and an implant ion dose greater than  $1.0 \times 10^{15}$  ions/cm<sup>2</sup>. Applicant is unable to find any reasonable disclosure of these features in the art of record.

As yet another example, new claim 86 depends directly from new claim 83 and recites that the hydrocarbon gas is methane. It is noted that this claim reflects the limitations of claim 30 which has been indicated as being allowable by the Examiner, but for its dependence on a rejected base claim. Accordingly, claim 86 is likewise believed to be allowable.

As a further example, new claim 87 depends directly from new claim 83 and recites that 75% methane and 25% oxygen form an overall gas mixture. It is noted that this claim reflects the limitations of claim 31 which has been indicated as being allowable by the Examiner, but for its dependence on a rejected base claim. Accordingly, claim 86 is likewise believed to be allowable.

If the Examiner has any questions concerning this case, the Examiner is respectfully requested to contact Mike Pritzkau at 303-410-9254.

Respectfully submitted,



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